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REPORT BY THE
Comptroller General
OF THE UNITED STATES

**Air Quality:
Do We Really Know What It Is?**

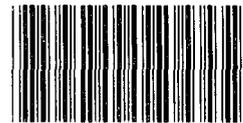
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Currently, air quality determinations across the country are based on information obtained from disparate State air monitoring networks. Deficiencies in these monitoring systems raise serious questions about the reliability and representativeness of the air quality data.

The importance of knowing the Nation's air quality and of achieving the Clean Air Act's goals necessitate the use of accurate, reliable information. Given the health and economic consequences of using questionable information, the issue is not whether we can afford the cost of assuring an accurate, reliable air monitoring system, but rather, can we afford not to?

Environmental Protection Agency actions to improve the situation have sometimes been slow and ineffective. In this report, GAO recommends several actions which the Agency and the Congress can take to correct the situation.



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CED-79-84
MAY 31, 1979



COMPTROLLER GENERAL OF THE UNITED STATES

WASHINGTON, D.C. 20548

B-166506

A.

The Honorable Toby Moffett
Chairman, Subcommittee on Environment,
Energy, and Natural Resources
Committee on Government Operations
House of Representatives

HSE 01508

Dear Mr. Chairman:

As requested in the Subcommittee's May 10, 1978, letter, and subsequent letters dated September 22, 1978, and December 6, 1978, we have reviewed the adequacy of the Environmental Protection Agency's air quality monitoring program. This is our report on the subject.

As arranged with your office, we will make this report available to other interested parties 30 days after the issue date, unless you publicly release its contents earlier.

At your request, we did not obtain written agency comments. The matters covered in this report, however, were discussed with agency officials and their comments are incorporated where appropriate.

Sincerely yours,

James B. Alton

Comptroller General
of the United States

COMPTROLLER GENERAL'S REPORT AIR QUALITY: DO WE REALLY
TO THE SUBCOMMITTEE ON KNOW WHAT IT IS?
ENVIRONMENT, ENERGY, AND
NATURAL RESOURCES
HOUSE COMMITTEE ON
GOVERNMENT OPERATIONS

D I G E S T

Reliable and comparable air quality data is critical to Environmental Protection Agency (EPA) efforts to regulate and enforce the requirements of the Clean Air Act and its amendments. Decisions made by EPA using air quality data are significant, as shown by a recent Council on Environmental Quality estimate that \$248 billion will be expended for air pollution abatement programs through 1986. (See p. 3.)

GAO's review of current monitoring activities in five cities and one county, as well as EPA documentation relating to other areas, however, raises serious questions about the reliability of some of the air quality data used in (1) assessing the progress made in attaining national air standards, (2) developing trends, and (3) establishing control strategies. Until a standardized, comprehensive air monitoring system exists, air quality data will provide a questionable basis for the policy decisions being made. (See pp. 5 to 17.)

Because of the significant economic and health related decisions for which this data is used, GAO recommends that the appropriate congressional committees or subcommittees hold oversight hearings to explore the progress being made in implementing the air monitoring regulation issued by EPA in May 1979, and to identify the additional actions needed to assure successful completion of the Clean Air Act goals.

Specifically, GAO believes these hearings should address such questions as:

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--How long before a national air monitoring system can be established?

--What will such a system cost? Who will pay for it?

--How does EPA plan to fulfill its congressionally mandated responsibilities under the Clean Air Act in view of the unknown reliability of the data currently available?

--What does EPA plan to do while the situation is being corrected? (See p. 31.)

Air quality data is a primary factor in determining the nature of air pollution problems in a geographic area, in conducting health research, in establishing health standards, and in developing and validating air quality control policies. The data is also used in judging the effect of emissions from new sources and for determining the permissible amount of deterioration in ambient air levels. To insure that a balance between environmental and socio-economic concerns is achieved, and that the policy alternative(s) provides for the greatest improvement in the overall quality of the Nation's air, at the least cost, accurate, reliable data is needed. (See p. 3.)

The quality and comparability of air data depends on three factors--the proper siting of monitoring stations, reliable and uniform equipment, and proper quality assurance controls. Using criteria developed by EPA, GAO found current air monitoring severely lacking in all three areas. Specifically, GAO's review disclosed that

--72 percent (174 of 243 evaluated) of the monitors were sited incorrectly; * →

--58 percent (142 of 243 evaluated) of the equipment in use was not certified by EPA; and

--overall, 81 percent of the monitoring sites had one or more problems which could adversely affect the data's reliability. (See pp. 5 to 12.)

Examples of problems found include (1) monitors used to measure the concentration of particulate matter being surrounded by trees or enclosures, thus preventing the proper air flow as well as the potential for screening particulate matter. (2) EPA had only approved 6 of the 28 ozone monitors in one city, and (3) EPA site evaluations for monitors in one large metropolitan city indicated that many sites were located such that they were not sampling air representative of that which most people were exposed to daily. (See pp. 7 to 13.)

In GAO's opinion, the problem stems from the fact that air monitoring is carried out by State and local agencies, using systems originally designed to meet their individual needs. A standardized, comprehensive air monitoring program is necessary for the successful implementation of the 1970 Clean Air Act, its recent amendments, and the enforcement of national ambient air quality standards. Such a program, however, is still not operational. (See p. 18.)

Not all the data generated by the monitoring systems is deficient, nor are all actions or decisions made on the basis of this data inaccurate. Progress has been made in improving air quality over the years. Actions, such as implementing transportation control plans, advancing technology to restrict harmful air pollutants from major stationary sources, and reducing emissions from mobile sources, have helped reduce air pollution. (See p. 28.)

Although EPA has recognized some of the problems with the air quality data, and has taken some action, its efforts to develop a standardized, comprehensive system have been slow and often ineffective.

In 1975, EPA formed a task force to study the air monitoring program. The task force's recommendations, coupled with a 1977 legislative mandate for a standardized air monitoring system, led EPA to promulgate a regulation, effective May 10, 1979, which requires that a standardized air monitoring program be established.

Preliminary State and local agency assessments of the regulation, as proposed, were somewhat negative. While agreeing with the regulation's intent, State and local officials believe it will be costly to implement, and is somewhat unrealistic and restrictive. For instance, adherence to the proposed height criteria would preclude some cities from monitoring for certain pollutants because they would be unable to place the monitors on building roof-tops, the most common location now used. (See pp. 20 to 24.)

The 1977 amendments to the Clean Air Act required EPA to promulgate, by August 1978, a regulation for implementing a standardized air monitoring system. This mandate was not met, as the regulation's effective date was not until May 10, 1979. (See pp. 20 to 22.)

Consequently, State plans for implementing such a system have been delayed, for States were reluctant to invest resources to analyze the proposed regulation until it was finalized. States are required to revise their implementation plans to conform with the regulation and be approved by EPA by May 1980.

As a result of the delay in promulgating the regulation and the significant deficiencies which need to be corrected, GAO believes EPA's goal of implementing a standardized, comprehensive air monitoring system by January 1981, will not be met. Rather, GAO believes it will not be until the mid-1980s before such a system will be operational and a sufficient period of time has passed to evaluate the data's accuracy and reliability. (See p. 28.)

The lack of a standardized, comprehensive air monitoring system capable of producing reliable and comparable data results in a great deal of uncertainty as to whether the public health is being adequately protected, or whether improvements in air quality have been accurately measured. Because the data produced by the air monitoring system required by EPA's regulation will directly affect the Nation's air pollution control efforts for many years, GAO recommends that EPA:

- Conduct a thorough evaluation of current air monitoring systems.
- Apprise the Congress of the cost and time needed to implement the regulation.
- Provide technical assistance to State and local agencies in preparing their implementation plans.
- Concentrate its efforts and expenditure of resources in areas most adversely affected by air quality designations.
- Take necessary precautionary measures in decisionmaking until sufficient, accurate data is available. (See pp. 27 to 29.)

AGENCY COMMENTS

Oral comments were obtained from EPA officials and, where appropriate, their comments and suggested revisions were included. EPA generally agreed with GAO's findings, conclusions, and recommendations.

While GAO believes that a proven, reliable national system will not be implemented until the mid-1980s, EPA believes its 1981 goal will be met. EPA also cited past efforts to improve State and local monitoring capabilities and added that steps are taken to assess data quality when making regulatory decisions. (See pp. 29 to 30.)

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CHAPTER 1

INTRODUCTION

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In a May 10, 1978, letter, the Chairman, Subcommittee on Environment, Energy, and Natural Resources, House Committee on Government Operations, requested that we examine the adequacy of the Environmental Protection Agency's (EPA's) air quality monitoring program. The subcommittee suggested that we examine monitoring programs in Boston, Massachusetts; New York, New York; and San Francisco and Los Angeles, California. In subsequent letters dated September 22, 1978, and December 6, 1978, the Chairman and a member of the subcommittee requested that we particularly examine the siting of air quality monitors, the equipment used, and the quality assurance procedures followed in Boston; Butler County, Ohio; New York; San Francisco; and Washington, D.C.

DESCRIPTION OF AIR
MONITORING PROGRAM

The Clean Air Act, as amended, mandates, among other things, that (1) the quality of the Nation's air be protected and enhanced, (2) technical and financial assistance be provided to State and local governments for their air pollution prevention and control programs, and (3) these governments receive assistance in developing and operating their programs. EPA is responsible for implementing the act's mandate for preventing deterioration in the Nation's air quality. Ambient air monitoring is an integral part of meeting this mandate; it provides a means to measure the progress made in improving air quality and to determine the need for regulatory controls.

Section 319 of the Clean Air Act Amendments of 1977 required that, 1 year after enactment, the Administrator, EPA, promulgate regulations establishing a nationwide air quality monitoring system. Such a system would establish monitoring stations throughout the United States. Using uniform monitoring criteria, the system would analyze and periodically report air quality data based on a uniform air quality index.

Clean Air Act Amendments of 1970

EPA has established national ambient air quality standards for various harmful pollutants. ^{1/} The States are responsible for controlling pollution to attain the standards. The control mechanism, as specified by section 110 of the Clean Air Act, is the State Implementation Plan. These plans are comprehensive planning documents used in attaining and maintaining the national standard for each pollutant. The plans also contain provisions for installing and operating the necessary air quality monitoring systems.

The States use the data from these monitoring systems to determine whether their controls are resulting in attainment of the national standards. EPA, in turn, bases its assessments of national air quality, to a large extent, on the data submitted from these systems.

The monitoring systems currently include about 9,400 monitors located throughout the United States and its territories. The breakdown of these monitors is shown in the following table.

Monitors in the United States (note a)

<u>Pollutant measured</u>	<u>Number of monitors</u>
Carbon monoxide	450
Nitrogen dioxide	1,579
Sulfur dioxide	2,618
Ozone	527
Total suspended particulates	4,234
Total	<u>9,408</u>

a/ Total monitors that reported data to EPA's national data bank in 1977.

1/ National ambient air quality standards have been promulgated for carbon monoxide, nitrogen dioxide, sulfur dioxide, ozone, hydrocarbons, total suspended particulates, and lead.

Federal grant funds are provided to State and local air pollution control agencies to establish and operate State Implementation Plans. In 1978, about \$62 million was awarded to State and local groups for air pollution controls, of which about \$15.6 million was used for monitoring.

ACCURATE, RELIABLE AIR
QUALITY DATA NEEDED

Accurate and reliable air quality data is essential because it serves as a primary basis for important health and socio-economic decisions. Ambient air monitoring data is used in judging compliance with the Nation's air quality standards and in directing the Nation's air quality control efforts. Accurate ambient air quality monitoring is essential to EPA in determining whether current regulations are achieving their intended objectives and in determining the viability of the States' control strategies. Air quality data is also used in establishing baselines against which to measure changes in air quality, assessing trends, anticipating problems, and initiating corrective actions.

Ambient air data is a principal factor in determining the nature of air pollution problems in an area, conducting health research and establishing health standards, and developing and validating ambient air data used in devising national control policies. The economic consequences of these policies are significant. The Council on Environmental Quality estimates total air pollution abatement expenditures will amount to an estimated \$248 billion during 1977-86. The last few years of inflation and energy shortages have caused concern as to whether the right balance has been struck between environmental--including air--quality objectives and economic and social goals. Since the cost of cleaning up air pollution is high, the most successful implementation of air pollution standards is that which considers overall costs and benefits and selects the alternative or alternatives that provide the greatest improvement in the overall quality of the Nation's air. For these goals to be achieved, all decisions must be based on accurate, reliable data.

SCOPE OF REVIEW

In response to the Chairman's and the subcommittee member's requests, we examined the monitoring programs in Boston, Butler County, New York, San Francisco, and

Washington, D.C. In each location we analyzed the adequacy of site selection, equipment used, and the quality assurance procedures followed at the monitoring sites we visited.

Since no uniform national air monitoring requirements exists, we used EPA's proposed monitoring criteria (published in the August 7, 1978, Federal Register) to evaluate the States' monitoring efforts and to assess the adequacy of the monitoring stations we visited. 1/ The criteria defines such elements of monitoring as: the siting of monitors (height above ground and distance from roadways, trees, and other obstructions); the types of allowable monitoring equipment (only instruments which EPA has tested and approved); and quality assurance procedures (when and how equipment should be calibrated and the procedures for precision and accuracy testing of equipment). Only by establishing the air monitoring system discussed in this report, can EPA determine how much the failure to comply with the criteria affects the reliability of air quality data.

We held discussions with EPA officials in Washington, D.C.; Research Triangle Park, North Carolina; and at regional offices in New York, Boston, and San Francisco. We also met with officials from the States of California, Massachusetts, New Jersey, New York, and Ohio, and from the cities of Boston, Cincinnati (regarding Butler County), Los Angeles, New York, and San Francisco. We examined documents, reports, and records from the agencies contacted.

While we did not evaluate all the monitoring sites in each location visited, we did visit randomly selected sites which report to State and local agencies for developing their State Implementation Plans, and sites identified as potential locations to be included in the national air monitoring system and State and local air monitoring systems.

1/ The regulation which sets forth substantially the same criteria was issued in the May 10, 1979, Federal Register.

CHAPTER 2

LACK OF A NATIONAL AIR

MONITORING SYSTEM IS DETRIMENTAL

TO CLEAN AIR ACT GOALS

No comprehensive, standardized air monitoring system has been established; rather, State and local agencies monitor air using networks designed to meet their individual needs. These systems are generating questionable data which does not provide a reliable basis for assessing trends or evaluating the progress made in complying with ambient air standards and which may not be truly representative. Specific weaknesses noted were: (1) improper siting of monitoring locations and air intake probes, (2) equipment not certified and/or approved by EPA, and (3) a lack of adequate quality assurance procedures.

Practically every monitoring location we reviewed had one or more problems which could adversely affect the reliability of the data generated. The following chart shows the number of sites which did not meet EPA's proposed criteria.

<u>Pollutant</u>	<u>Number of monitors evaluated</u>	<u>Number with no problems</u>	<u>Number not meeting criteria for one or more reasons</u>	<u>Percent not meeting criteria</u>
Total				
suspended particulates	81	33	48	59
Sulfur dioxide	56	7	49	88
Nitrogen dioxide	30	2	28	93
Carbon monoxide	33	1	32	97
Ozone	<u>43</u>	<u>3</u>	<u>40</u>	<u>93</u>
Total	<u>243</u>	<u>46</u>	<u>197</u>	<u>81</u>

MONITORING SITES IMPROPERLY LOCATED

An air monitoring network should be designed to ensure that the data generated is representative of the area; is not unduly influenced by major sources of pollution; and satisfies all State, local, and EPA data needs. To accomplish this, EPA's proposed criteria requires that monitors be sited at a certain height and distance from obstructions and possible pollution sources. The proposed criteria states that air intake probes should be no less than two meters and not more than 15 meters above the ground and should have an unrestricted air flow for three of the four wind directions. Also, minimum distances from roadways, trees, buildings, and other obstructions are set forth. (See app. I for detailed criteria.)

We evaluated 243 monitors and found that 174, or about 72 percent, did not conform to EPA's proposed siting criteria. Many sites vary significantly from the EPA proposed siting criteria. Problems noted were probes located 3 or 4 times the height and distance criteria, as well as having restricted air flow. The following chart summarizes, by pollutant, the siting adequacy for the monitoring stations we evaluated.

<u>Pollutant</u>	<u>Number of monitors evaluated</u>	<u>Number not meeting EPA's proposed siting specifications</u>	<u>Percent not meeting siting specifications</u>
Total			
suspended particulates	81	47	58
Sulfur dioxide	56	39	70
Nitrogen dioxide	30	26	87
Carbon monoxide	33	25	76
Ozone	<u>43</u>	<u>37</u>	<u>86</u>
Total	<u>243</u>	<u>174</u>	<u>72</u>

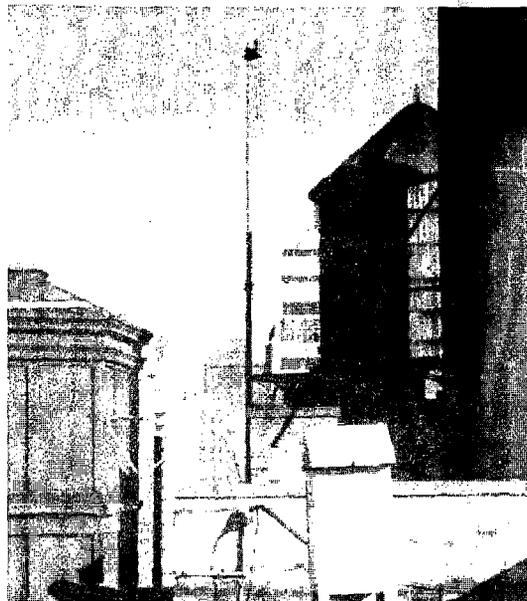
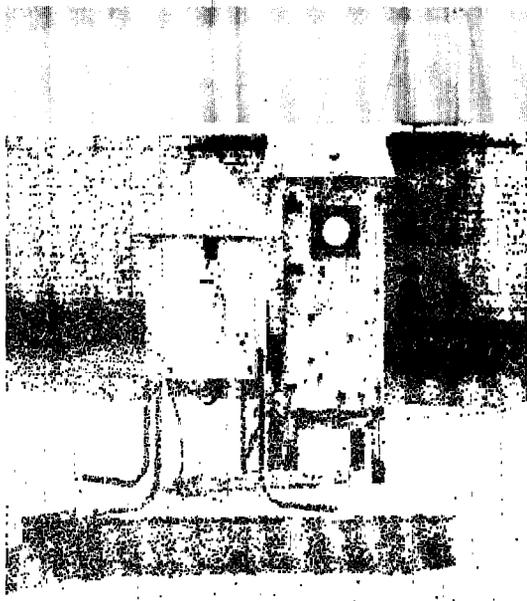
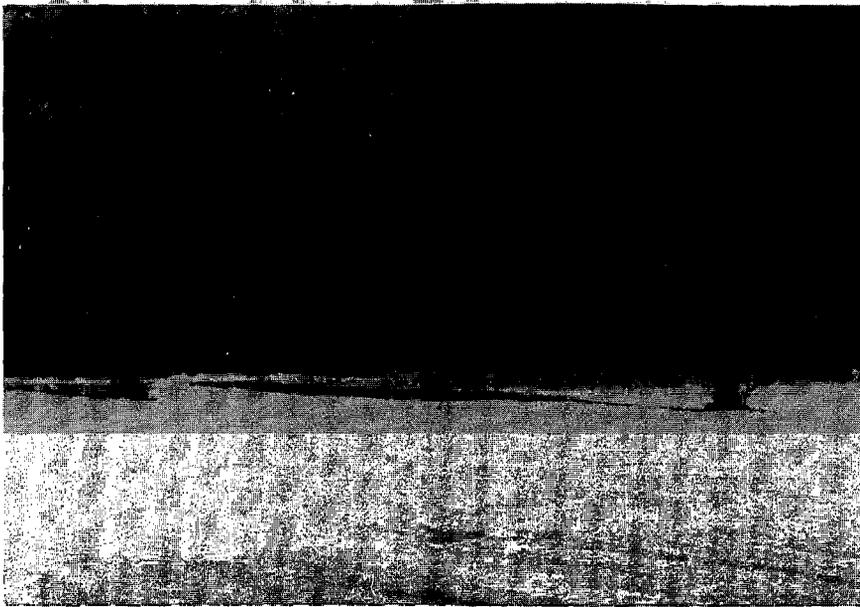
Specific examples of improper siting conditions we found included:

- Monitors used to determine the concentration of particulate matter were surrounded by trees or enclosures which prevents the proper air flow and increases the potential for screening particulate matter, which could result in unrepresentative data.
- Numerous air inlets and probes were positioned on top of multistory buildings--far above the height limit in the proposed regulation. In one major city we visited, only two carbon monoxide probes met the siting criteria.
- Many air inlets and probes contained dirt and other foreign matter. An EPA official related instances where bird nests were found in air-intake probes.

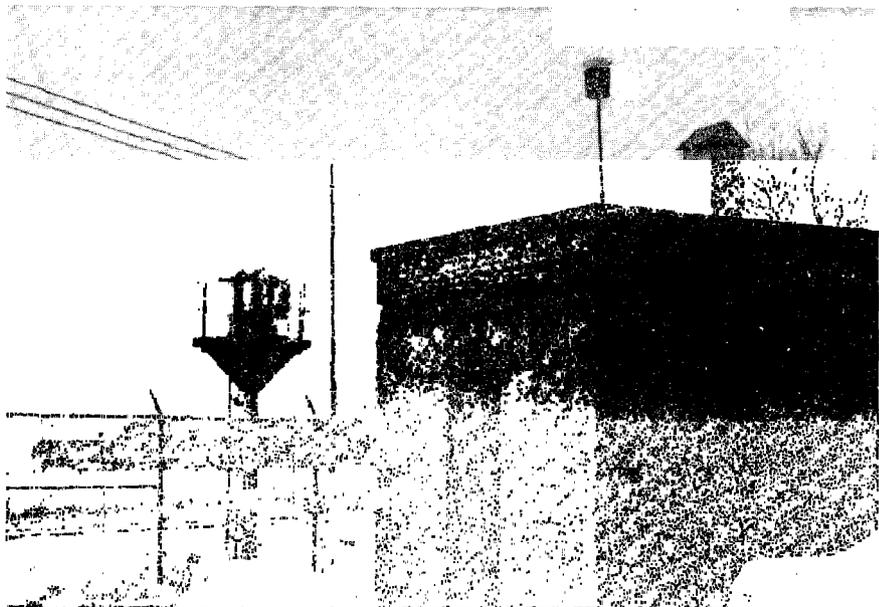
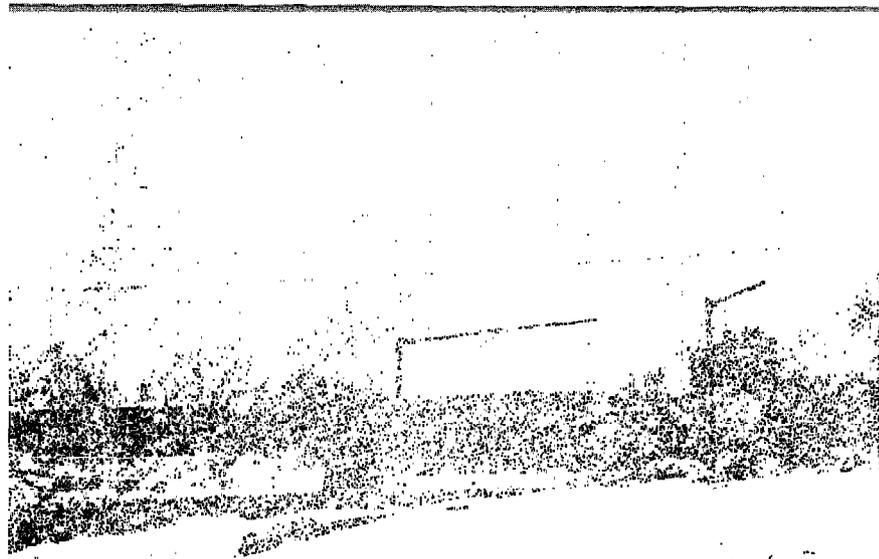
Often, the need for (1) a convenient power source to operate monitors, (2) accessibility for service and maintenance, and (3) security from vandalism were given more weight in deciding the monitor locations than was the scientific criteria discussed above, resulting in inadequate sites.

Improper siting can produce data which is not representative of the air we breathe. For instance, many monitoring sites in one city we visited were located either high above street level or in areas such that they did not truly represent the exposure to pollutants which most people would experience in their daily lives. EPA noted this situation in its 1977 evaluation of these sites; however, these sites continue to operate. One site which EPA noted was not representative was expanded from monitoring for one pollutant to monitoring for three pollutants.

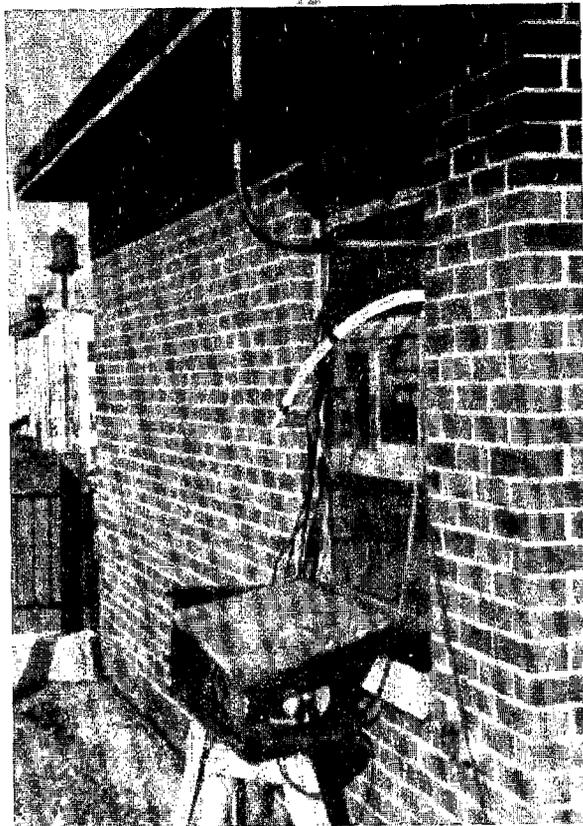
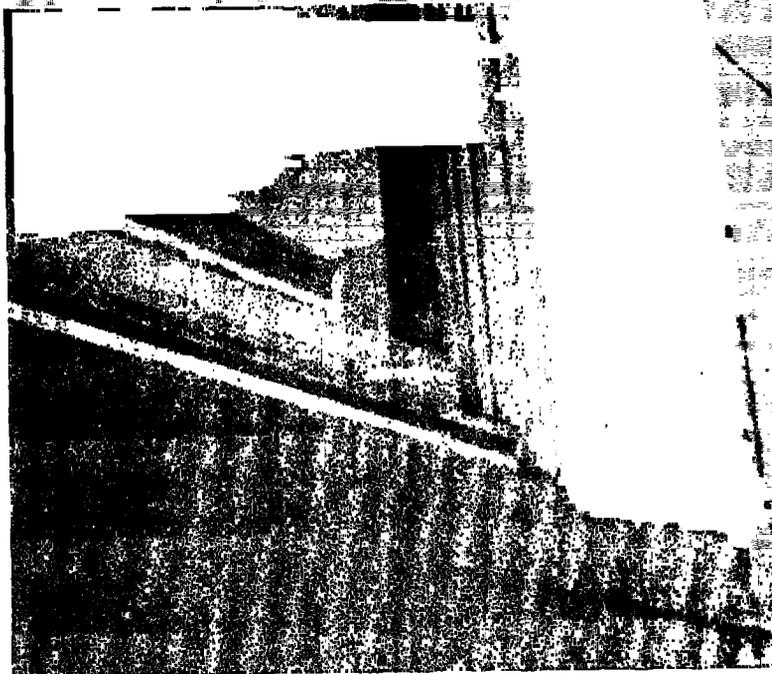
The photographs on the following pages illustrate several siting deficiencies disclosed in our review.



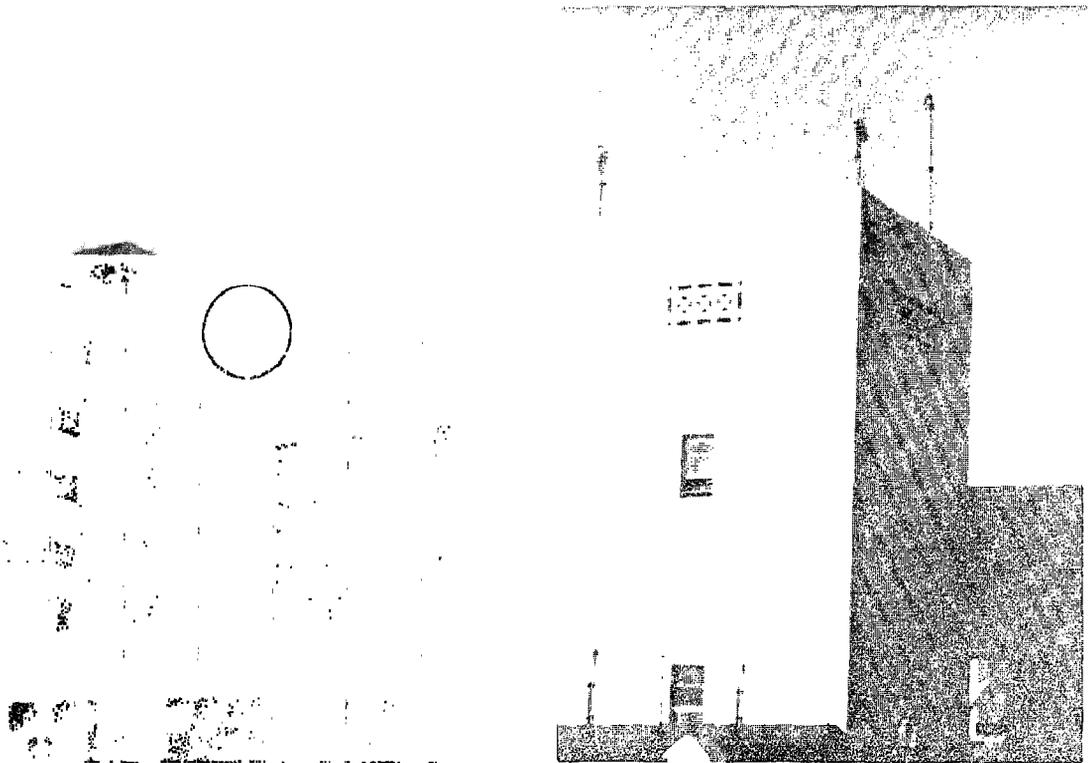
EXAMPLE OF RESTRICTED AIR FLOW TO MONITORS.



EXAMPLE OF A MONITORING SITE WHICH COULD BE UNDULY INFLUENCED BY A MAJOR SOURCE OF POLLUTION. THE PICTURE ON THE BOTTOM SHOWS THE STATE MONITOR (LOCATED ON TOP OF THE BUILDING) AND THAT OF THE COMPANY (LOCATED ON OPPOSITE SIDE OF THE WIRE FENCE). BOTH MONITORS ARE LOCATED IN CLOSE PROXIMITY TO THE SMOKESTACKS SHOWN IN THE PICTURE ON THE TOP.



EXAMPLES OF PROBES NOT EXTENDED SUFFICIENTLY TO OBTAIN REPRESENTATIVE AIR SAMPLES.



EXAMPLE OF PROBES LOCATED TOO HIGH ABOVE THE GROUND TO OBTAIN REPRESENTATIVE AIR SAMPLES.

MANY MONITORING SYSTEMS
USE UNACCEPTABLE EQUIPMENT
WITH LESS THAN SATISFACTORY
RESULTS

The quality and comparability of ambient air data largely depends on the correct use, by well-trained personnel, of reliable and comparable equipment. Recognizing this, EPA issued standards in 1975 for the equipment used in monitoring and analyzing air samples. These standards established the technical characteristics and performance requirements of the equipment. Once a manufacturer's equipment meets all established standards, EPA certifies the equipment as acceptable or approved. We found, however, that equipment varied between systems and that about half of the equipment did not meet EPA's standards.

The following chart shows, by pollutant, the results of our analysis of the equipment in use at the monitoring stations we reviewed.

<u>Pollutant</u>	<u>Number of monitors evaluated</u>	<u>Number using unacceptable or uncertified equipment</u>	<u>Percent unacceptable</u>
Total			
suspended particulates	81	19	23
Sulfur dioxide	56	40	71
Nitrogen dioxide	30	26	87
Carbon monoxide	33	26	79
Ozone	<u>43</u>	<u>31</u>	<u>72</u>
Total	<u>243</u>	<u>142</u>	<u>58</u>

Examples of problems with equipment included the following.

--In one State system EPA had not approved any of the 19 in-use carbon monoxide monitors.

--In one city EPA had only approved 6 of the 28 ozone monitors.

--One EPA regional Director of Surveillance and Analysis, in a January 1978 memorandum, stated that 64 percent (124 of 195) of the sulfur dioxide monitors in his region had major operational problems. Additionally, 50 percent (180 of 360) of the total suspended particulate monitors in his region had some deficiency which could affect the data's reliability.

As an integral part of their monitoring systems, many State and local agencies operate laboratories to analyze the samples collected by their monitors. Currently, neither the staff nor the laboratories are required to be certified by EPA. Since 1972, however, EPA has audited participating laboratories to provide self-evaluative feedback to the State and local agencies and to provide a continuing index of the quality of data being reported to its air quality data bank.

The audit's results measure the laboratories' accuracy in analyzing unknown samples of various pollutants EPA sends to them. In January 1978, EPA published, for the first time, the results of those audits performed from October 1976 through December 1977. The statistics showed that about 15 percent of the participating laboratories produced inaccurate analysis and, in EPA's opinion, needed immediate technical assistance. Seventy-five percent produced mixed results. Only about 10 percent accurately analyzed the sample.

Agency officials told us that the quality of data reported to EPA would increase if the people who collect and analyze the air samples were required to be certified.

ADEQUATE QUALITY ASSURANCE
PROCEDURES NOT USED

Using acceptable equipment, sited in representative locations and operated by well-trained personnel, does not necessarily guarantee high quality reliable data. If mistakes--such as equipment failing to function properly or people failing to follow prescribed procedures--go unnoticed, invalid data can enter the reporting system and be used in decisionmaking. Quality assurance procedures are designed to prevent such an occurrence.

EPA's regulation points out that while an adequate quality assurance program can be costly, it is "entirely justified" considering the economic impact of the decisions based on ambient air quality data. The regulation calls for implementing specific procedures to ensure the accuracy of the equipment and the method used in monitoring and analyzing collected air samples. Such procedures include specified calibration requirements, physical and/or chemical techniques used to determine pollutant concentrations, and requirements for the number of samples to be collected in specified time frames.

At the time of our review, there was no national requirement for a quality assurance program. Consequently, some States have no quality assurance programs, while others have implemented some quality assurance procedures. The following lists the typical deficiencies we found in existing quality assurance programs:

- No standardized written program had been implemented.
- Quality assurance checks were conducted by the people who operated the equipment; therefore, the assessment may not be objective.
- Personnel were insufficiently trained.
- Monitoring equipment was calibrated infrequently and disparately.

In 1976 one EPA region evaluated air monitoring quality assurance in its region and found that 19 of 26 programs were unacceptable. The consequence of not having quality assurance is severe because no basis exists for assessing the data's accuracy or reliability. For example, we found one reported incident of paint particles on the filter pads of three particulate samplers. Since the concentration of pollutants on particulate samplers is determined by weight, this condition would result in artificially high readings. Another EPA regional audit revealed that both the carbon monoxide and ozone analyzers were not reporting accurate data due to equipment malfunctions.

A January 1978 memorandum from one EPA region's Surveillance and Analysis Division Director to the Regional Administrator summarizes the impact of such problems. The memorandum stated:

"While the above information shows the magnitude of the quality assurance and quality control problems being faced in this region, we still have insufficient information for assessing the accuracy or bias of the data from these sites because our audits and those of the states are too infrequent to allow such an assessment. With our continuing and increased emphasis on quality assurance and quality control, and with the new regulations being published for SAMWG implementation, we expect to not only reduce the number of major and minor problems being found but also to be able to assess the precision and accuracy of the data being generated and make such assessments available to the users. At the present time, all we can state about our data is use with caution."

EPA has also developed statistical screening procedures to help establish the completeness of the reported data. EPA has a goal for at least 75 percent of all monitors to report data which covers a sufficient period of time to be considered complete. This goal has not been met for any of the five criteria pollutants. Only about 56 percent have met this goal, as shown by the following chart.

<u>Pollutant</u>	<u>Number reporting</u>	<u>Number EPA considers complete for statistical averaging</u>	<u>Percent considered complete</u>
Total suspended particulates	4,234	2,707	64
Sulfur dioxide	2,618	1,354	52
Carbon monoxide	450	173	38
Nitrogen dioxide	1,579	874	55
Ozone (note a)	<u>527</u>	<u>176</u>	<u>33</u>
Total	<u>9,408</u>	<u>5,284</u>	<u>56</u>

a/ EPA guidance to State and local agencies permits them to discontinue monitoring for ozone during the winter months (nonozone producing months).

OTHER PROBLEMS AFFECTING THE QUALITY OF AIR MONITORING DATA

Other problems which cumulatively affect the quality of air monitoring data are a lack of emphasis on monitoring within EPA and ineffective controls over grant money.

A 1977 National Academy of Science report found, among other things, that no focal point existed in EPA for monitoring and concluded that EPA did not adequately apply scientific principles to the design, operation, and evaluation of monitoring programs. The Academy recommended that EPA establish an Office of Science to coordinate environmental monitoring within EPA and between EPA and other Federal, State, and local agencies.

Each EPA region has the authority to negotiate with State agencies for the use of grant funds. If States do not use the funds as agreed, the regions can withhold future grants. We were informed, however, that this rarely occurs because EPA needs the monitoring data. Consequently, States have not always used grant money to resolve problem areas. For instance, in 1975 EPA required that States must have comparable, EPA-approved equipment by 1980. However, we were told that this will not occur until the mid-1980s. If EPA had required States to spend part of their grant funds to replace equipment this situation may have been averted.

CHAPTER 3

EPA'S EFFORTS TO IMPROVE THE

QUALITY OF AIR MONITORING

HAVE BEEN SLOW AND INEFFECTIVE

In our opinion, a standardized, comprehensive ambient air monitoring program is necessary for the successful implementation of the 1970 Clean Air Act, recent amendments, and the enforcement of national ambient air quality standards. EPA and the private and public sectors have long recognized the need for such a monitoring system. In spite of this recognition, however, a standardized, comprehensive air quality monitoring system which is capable of producing reliable and comparable data is still not operational.

The lack of reliable data detrimentally affects the successful implementation of the recent Clean Air Act amendments. These amendments required each State to designate--on a pollutant-by-pollutant basis--the air quality status within its geographic boundaries and to develop control strategies for improving the air quality, if necessary. The amendments also reinforced the Congress intent to prevent deterioration of air quality in areas which are cleaner than the ambient air standards and established an offset policy for emissions from new pollution sources in areas not meeting the standards. Because of the monitoring data's unreliability and noncomparability, these provisions may not be fairly, effectively, or adequately implemented.

RECOGNITION OF INADEQUATE MONITORING

The existing air monitoring programs have been criticized ever since they were developed. In the past several years, many reports have been issued which discuss the weaknesses and inconsistencies in the air monitoring system.

The President's Council on Environmental Quality's first annual report in 1970 recommended that Federal, State, and local air monitoring systems be improved. The report noted the need for inexpensive automated instruments, more monitoring stations, and improved standard methodology. The Council also reported that monitors were incorrectly sited and much of the monitoring data was spotty and intermittent, thus limiting its usefulness. The Council's 1975 annual report again discussed problems with the data's quality.

In 1977, two scientific reports were issued criticizing EPA's monitoring and lack of quality assurance. In a publication entitled "Environmental Monitoring," the National Academy of Sciences criticized EPA's data handling and the proliferation of uncoordinated, inefficient, and inflexible monitoring programs that produce data of poor or unknown quality. The National Advisory Committee on Oceans and Atmosphere repeated many of these same criticisms in its sixth annual report dated June 30, 1977. The report recognized that data was often not suitable for comparison, making assessments of nationwide trends difficult.

The National Advisory Committee stated that, although EPA was aware of the problem and had acted to improve matters, "* * * the improvement of monitoring appears to have a lower priority within the agency than we believe is justified." The Committee concluded that effective air pollution control required a more sound base of high quality information than was then available.

A 1977 EPA contractor's report also expressed concern over the reliability of ambient air data. The report summarized the results of a survey taken to identify those monitoring sites from which consistent data could be attained. The report noted that air quality trends were difficult to measure or to compare among major pollution centers because siting standards, quality assurance procedures, and sampling techniques differed among air quality monitoring sites. In addition, a 1977 regional EPA monitoring site survey concluded that, because of deficiencies disclosed, the monitoring data should be used with caution.

In a Council on Environmental Quality fact sheet accompanying the President's May 1977 message to the Congress on the environment, the reliability of monitoring data was further questioned:

"As the nation's awareness of environmental problems has grown over the past decade, so has its need for sound technical information and data to help guide environmental decisions and policies. More than a hundred Federal programs from nearly every major agency presently generate data, statistics, and analytical information about environmental conditions, trends, and their causes. We depend heavily on the information from these programs, many of which are well conducted.

"Yet, there are major deficiencies. Large gaps, wasteful duplications, questionable validity, and lack of coordination characterize many of the nation's environmental monitoring and data programs."

CONGRESSIONAL AWARENESS OF PROBLEMS WITH AIR QUALITY MONITORING

The Congress has also become aware of the ambient air monitoring systems' inadequacies. During several congressional hearings in 1975 and 1976 on issues relating to the Clean Air Act, several witnesses criticized the quality of air monitoring data. The House of Representatives, in 1975, proposed an amendment which included a provision to upgrade the ambient air monitoring systems. Under this amendment, EPA was to promulgate regulations to establish a standard air quality index by which to measure trends. The amendment, however, failed to become law in 1975 or 1976.

In August 1977, the Congress succeeded in amending the Clean Air Act to establish, among other things, the need for a standardized, comprehensive national air monitoring system. The amendments also called for EPA to promulgate, by August 1978, a regulation which the States would be required to follow in establishing a standardized, comprehensive air monitoring program.

EPA'S RESPONSE TO CRITICISM OF MONITORING

EPA has not been completely inattentive to the increasing criticisms of the air monitoring system. EPA has issued guidance and requirements for siting of monitors, using uniform equipment, and developing quality assurance programs. It has also initiated studies on the monitoring system. Despite these efforts, however, a standardized, comprehensive air monitoring system is not yet operational. EPA's efforts, though somewhat responsive to the problems, have not been as strong or timely as necessary.

In August 1973, EPA issued interim guidance to State and local agencies on the siting of monitors. These guidelines were redrafted in September 1975, but were never issued as requirements. As acknowledged by State and local air pollution control officials, as well as EPA officials, the draft guidelines were not much assistance, for many monitoring locations were established long before the guidelines were prepared.

Also in 1975, EPA promulgated a regulation requiring the use of standardized, approved equipment. Because of the large investment the States have in their equipment, EPA is allowing the States to gradually replace their unaccepted and unapproved equipment with equipment which EPA has tested or certified as capable of reporting quality, accurate data. The cutoff date for this replacement is February 1980; theoretically, all States will then be using the same uniform, reliable equipment.

EPA also developed guidelines for a quality assurance program, but the adoption of these guidelines was voluntary; consequently, they have not been implemented at all in some areas, while other areas have adopted only parts. EPA officials have told us that, while quality assurance is essential for a reliable monitoring system, it is often overlooked.

In the fall of 1975, an EPA task force was formed to review air monitoring activities. The resulting report, entitled "Air Monitoring Strategy for State Implementation Plans," issued in June 1977, recommended that an approved air monitoring network be implemented by a joint Federal-State-local effort. The study emphasized the importance of timely data which is complete, precise, accurate, and comparable. The task force listed monitoring activities that needed attention, as well as recommendations for their improvement. Five specific problems with the air monitoring program which the task force identified were:

- More monitoring sites were operating than were needed to determine ambient air and to develop trend data.
- Many sites were located in inadequate areas for monitoring.
- Quality assurance programs were lacking.
- The lack of quality data precluded routine trend analysis.
- Much of the air trend data was of an unknown quality.

The task force proposed a number of corrective actions to EPA, including:

- Expanding EPA's efforts to establish a formal and comprehensive quality assurance program.

- Modifying existing monitoring regulations to establish a national air monitoring system and a State and local air monitoring system to be implemented in January 1981 and January 1983, respectively.
- Standardizing the use of statistical and simulation modeling techniques.
- Issuing guidance to State and local air pollution control agencies on the collection of source emission data for national trend analysis.
- Developing a uniform air quality index.

The task force also proposed that EPA develop uniform air quality monitoring criteria for monitoring network design, probe siting, and monitoring methodology.

In August 1978, EPA proposed a regulation encompassing many of these recommendations and requirements. The regulation calls for, among other things, the establishment of a standardized, national air monitoring system and a quality assurance program. It also introduces uniform criteria for States to follow in siting monitors and air intake probes, thus achieving comparability of data. The regulation was published in the Federal Register on May 10, 1979, with an effective date of May 10, 1979. States are required to revise their implementation plans to conform with the regulation and be approved by EPA by May 1980.

Because of the delay in promulgating the criteria (mandated to be issued by August 1978, but not issued until May 1979), State and local officials told us that, based on past experience with EPA procedures, they would not invest scarce resources to evaluate their current monitoring systems until required to do so.

NEGATIVE REACTION TO EPA'S REGULATION

Although most State and local officials agree that there is a need for a standardized, comprehensive monitoring network to produce valid, comparable data, they believe that EPA's criteria for implementing such a network is restrictive, costly, and unrealistic.

Restrictive

The criteria will be set forth as a regulation, thus requiring strict adherence. Comments sent to EPA suggested

that the criteria be issued as a guideline, thus allowing a degree of flexibility. One city, for example, felt that strict adherence to the height criteria would preclude monitoring for the greater part of the city, because most of the buildings are multistory.

EPA believes that the criteria should remain a requirement, with waivers being allowed for exceptional cases where the criteria simply cannot be met. For example, waivers for the height of probes may be granted provided the resulting sample is representative of the ambient air.

Costly

While most officials have not evaluated the regulation in detail in terms of implementation costs, initial reaction is that it will be costly. Officials point to the quality assurance requirements, the probable site relocations, and the possible need for new equipment as being potentially expensive revisions. EPA estimates that the cost of implementing all the regulation's requirements will be \$35 million. The State and local officials we met with, however, told us that the Federal Government will have to provide virtually all of these funds.

We were told that EPA is considering the use of grant funds to help the States and local agencies implement the regulation.

Unrealistic

According to some comments, the siting criteria does not take into consideration the various problems associated with siting in an urban area. For example, the criteria requires that the monitoring site have an unrestricted air flow and, for certain pollutants, the probe be not more than 10 feet above ground. This eliminates the use of many city buildings' roof-tops for sites (the most commonly used location) as they either exceed the height criteria or are surrounded by taller buildings. EPA may, however, grant waivers for exceptional situations.

Concern about the regulation has also been expressed within EPA, particularly over the quality assurance requirement. The task force report recommended that an extensive quality assurance program be required of all States as soon as possible. The resulting regulation is substantially less extensive, due to various comments from State and local

agencies regarding the excessive resources that would be required to implement the recommendations.

EPA officials in the Office of Research and Development feel that although expensive, the quality assurance program is justified considering the economic impact of decisions based on air quality data. EPA officials have categorized the regulation's quality assurance provisions as a "minimal" program.

EFFECT OF UNRELIABLE DATA AND ITS IMPACT ON
SPECIFIC MANDATES IN THE CLEAN AIR ACT

As required by the Clean Air Act Amendments of 1977, States were to identify, on a pollutant-by-pollutant basis, the attainment status of every area within its boundaries, which would insure that established deadlines were met. These designations were primarily based on ambient air monitoring data. Three categories of designation resulted: attainment, nonattainment, and unclassified. Areas which have been designated as attainment and those which cannot be classified due to insufficient air monitoring data have not been required to submit control strategies. Nonattainment areas, however, were required to submit State Implementation Plans to EPA by January 1979, describing control strategies for attaining the national air standards by December 1982 or, in some cases, 1987.

Since, in our opinion, much of the monitoring data used in making these determinations is of unknown quality and may be unreliable, the designations may not all be accurate and, therefore, some of the resulting control strategies may also be inaccurate or possibly unneeded. Therefore, there is no assurance that proper or sufficient controls to meet the 1982 deadlines will be implemented or that areas needing the most attention have been identified. Further, EPA has not required areas designated as unclassified due to a lack of monitoring data or insufficient monitoring data to submit control strategies or to begin monitoring ambient conditions, except for ozone. In effect, these areas have been granted an indefinite grace period. According to EPA officials, except for a few priority ozone areas, no policy has yet been established for these areas, although monitoring must be accomplished by any major new source proposing to operate in these area.

We analyzed numerous comments regarding attainment designations from States, local agencies, and private groups and found the basic concern to be the potential punitive effect of being designated nonattainment.

Questions were raised concerning the validity of these designations. EPA officials stated that it was unfair to expect areas to offer control strategies for a problem that might not be properly identified.

An example of the reaction to the potential implications of being designated as nonattainment was demonstrated recently in Butler County, Ohio. Due to an apparent misunderstanding about the official designation of an area, a group of local businessmen were, at the time of our review, about to award a \$400,000 contract for a private monitoring system designed to meet EPA's proposed regulation. The intent of establishing this private monitoring system was to document the area's compliance with EPA's ambient air standards and thus disprove what the group thought was an EPA action designating the area as nonattainment.

Another example of the potential consequences of this situation involves a legal proceeding between the State of New Jersey and EPA. The State has been designated as nonattainment for ozone, but contends that all States have an ozone problem. The State of New Jersey feels that because it has performed monitoring and thus identified ozone as a problem it will be economically penalized while States which are not classified will not be penalized.

The monitoring data's questionable reliability also affects the successful implementation of other sections of the Clean Air Act. The act, as amended in August 1977, reinforced the Congress desire to prevent further deterioration of the Nation's air quality. The section entitled "Prevention of Significant Deterioration of Air Quality" established a policy for assuring that those areas attaining the national ambient air quality standards would not deteriorate further.

All areas in the country were required to be placed into one of three classifications:

- Class I. Pristine areas (National parks, wilderness area, etc.) in which little or no air pollution will be permitted.
- Class II. Areas which may have a limited increase in air pollution each year. The amount of increase permitted each year is determined by the difference between current pollution levels and the amount permitted by the ambient air standards.

--Class III. Areas where greater increments of degradation than that allowed in Class II are allowed. Most of this will result from new source construction and development.

Deteriorating air quality in areas not attaining the national standards will be controlled through the new source review program. This program will provide a mechanism whereby economic expansion can occur in nonattainment areas, without hampering the Clean Air Act goals. Under this program, States must impose strict requirements for new sources, including a permit procedure whereby all proposed new sources can be reviewed. New source permits may not be issued unless the new pollutants can be offset by reducing emissions of the same pollutant in the nonattainment area, and all new sources will use equipment designed to accomplish the "lowest achievable emission rate."

The above Clean Air Act programs or requirements illustrate the need for high quality data. Unless such data is available, successful and uniform implementation of the act's goals and objectives cannot be accomplished.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Effective air pollution control requires more valid and higher quality information than is currently available. A standardized, comprehensive ambient air monitoring program is necessary for the successful implementation of the 1970 Clean Air Act, recent amendments, and the enforcement of national ambient air quality standards. States and local agencies have not been required to follow standardized siting, equipment, or quality assurance procedures in measuring the concentration of harmful pollutants. Because such criteria has only recently been promulgated, the quality and reliability of some of the data generated today, as well as in the past, is not known.

Some data currently being used is based on improper monitoring locations, nonuniform equipment, and inadequate quality controls. Consequently, EPA's assessment of the Nation's air quality has been and will continue to be based on data of unknown quality for some areas. Deficiencies in the quality of monitoring data may also be distorting the Nation's air pollution problems. Therefore, at this time, it is uncertain whether the public health is being adequately protected, what degree of improvement in air quality has been accomplished, or whether a different approach is needed to achieve the Clean Air Act's goals.

The number of deficiencies we found in the improper siting of monitoring stations and air intake probes, the extent that non-EPA approved instrumentation was used, and the lack of proper quality assurance procedures were alarming. Errors in any of these basic components of a good monitoring system will affect the overall reliability of information generated from that system. Therefore, using this data for such purposes as assessing progress made in attaining ambient air standards, developing trends, establishing control strategies, judging what amount of further deterioration should be allowed, or deciding what and how much pollution to be allowed from new sources can not be done with a high degree of confidence.

EPA's actions to improve the quality of air monitoring data have been slow and often ineffective. The need for improvements has been recognized for some time, yet a corrective regulation has only recently been issued.

Consequently, because of the delay in issuing this regulation, States have been reluctant to devote scarce resources to evaluating their systems' capabilities and needs.

Considering all that still needs to be completed before a national, standardized system can be implemented, it appears that the January 1981 goal for establishing a national, standardized air monitoring system will not be met. Rather, we believe it will not be until the mid-1980s before such a system will be operational and a sufficient period of time has passed to evaluate the data's accuracy and reliability.

Not all the data generated by the monitoring systems is deficient, nor are all actions or decisions made on the basis of this data inaccurate. Progress has been made in improving air quality over the years. Actions, such as implementing transportation control plans, advancing technology to restrict harmful air pollutants from major stationary sources, and reducing emissions from mobile sources, have helped reduce air pollution.

However, the significant economic and health decisions that EPA must make require accurate, reliable, and comparable data and this can only be realized if a comprehensive, standardized ambient air monitoring system is implemented and enforced in a timely and efficient manner.

RECOMMENDATIONS TO THE ADMINISTRATOR, EPA

EPA needs reliable and representative air quality data to make informed health-related decisions, therefore, we agree with the objectives of EPA's recently issued regulation. However, it must be implemented and enforced before the objectives can be achieved. Since the data generated from the standardized, comprehensive air monitoring system required by this regulation will directly affect the Nation's air pollution control efforts for many years, we recommend that EPA act to assure strict adherence to its requirements. Specifically, we recommend that EPA:

- Thoroughly evaluate existing air monitoring systems to determine those actions needed to assure compliance with the monitoring regulation.
- Inform the Congress of the cost and time needed to implement the regulation. Periodic reports should be submitted to the Congress on the status of the regulation's implementation.

- Provide technical assistance to State and local agencies in preparing implementation plans to insure their timely completion and approval.
- Concentrate its expenditure of resources in those areas which have been designated as nonattainment, since they must submit revised air pollution control strategies. EPA should give priority to establishing a reliable, representative air monitoring program in these areas first, considering population density and the extent of pollution, so that sufficient, reliable data is available to validate and assess actual air quality.
- Until sufficient, accurate data is available, EPA should take necessary precautionary actions in decisionmaking.

AGENCY COMMENTS AND OUR EVALUATION

We obtained oral comments from EPA and, where appropriate, its comments and suggested revisions were included. EPA generally agreed with our findings, conclusions, and recommendations. Following are the major issues discussed.

Validating air monitoring data

In commenting on our draft report, EPA officials stated there are inherent limitations in using ambient air monitoring data and added that these limitations are considered in the decisionmaking process. They stated that unusual air quality readings may result from atypical weather conditions; unusual release of pollutants due to accidents; or temporary emissions, such as the demolition of a building. Officials further stated that even when monitors are properly sited, uniform equipment is used, and proper quality assurance procedures are practiced, the air quality manager must be aware of events that account for unusual readings and that data must be carefully evaluated before it becomes a factor in any regulatory decision.

We recognize that unusual conditions or events may influence air quality and that these situations must be considered when evaluating air quality. However, based on the magnitude and cumulative effect of the deficiencies identified in our review--improper siting of air intake probes, lack of proper quality assurance procedures, and use of nonuniform equipment--the current monitoring systems are generating data of such unknown quality and unrepresentativeness that effective and equitable enforcement of the Clean Air Act's provisions is highly questionable.

Although unusual readings may be screened out, the remaining data may not be comparable or reliable because of the deficiencies in the monitoring systems which generated the data in the first place. We agree with EPA that even data generated from adequate monitoring systems must be evaluated; however, our review disclosed that the monitoring systems currently in use are so deficient that they cannot be classified as adequate. Therefore, it must be recognized that much of the monitoring data previously generated is of unknown quality and is not comparable.

EPA has recognized many of the deficiencies in the current systems and the recent issuance of the air monitoring regulation indicates that corrective actions are forthcoming. Until the air monitoring regulation is successfully implemented, EPA must use extreme caution in enforcing the mandates of the Clean Air Act. Screening and evaluating data must continue, but not until the regulation is implemented, will a basis for determining whether the data is reliable and comparable exist.

Implementing the national air monitoring system

EPA disagreed with our contention that the national air monitoring system will not be implemented until the mid-1980s. EPA believes that its 1981 goal will be met because (1) both EPA and the States have recognized the need for such a system and have made implementation of the system a priority and (2) adequate funding will be made available for implementing the system.

As previously noted, States have until May 1980 to develop an approved implementation plan. Because of the delay in promulgating the regulation (mandated to be issued by August 1978 but not issued until May 1979) and the States reluctance to evaluate their air monitoring systems until the regulation was issued, it is doubtful that the States have done much to prepare for the system's implementation.

Because of the time needed to purchase and properly site equipment, train personnel, develop and institute quality assurance programs, and operate the system for a sufficient time to ensure the data's accuracy and reliability, we still believe it will not be until the mid-1980s before a national system will be operational.

RECOMMENDATION TO THE CONGRESS

Because of the economic and health decisions affected by ambient air quality data, and the unknown reliability of much of that data, we recommend that the appropriate congressional committees or subcommittees hold oversight hearings. These hearings should explore the progress being made in implementing the air monitoring regulation issued by EPA in May 1979, and to identify the additional actions needed to assure successful completion of the Clean Air Act goals. Specifically, we believe these hearings should address such questions as:

- How long before a standardized, comprehensive air monitoring system can be established?
- What will such a system cost and who will pay for it?
- How does EPA plan to fulfill its congressionally mandated responsibilities under the Clean Air Act in view of the current data's unknown reliability?
- What does EPA plan to do while the situation is being corrected?

SUMMARY OF PROBE SITING CRITERIA

Pollutant	Height above ground, meters	Distance from supporting structure, meters		Other siting criteria
		Vertical	Horizontal ^a	
TSP (All spatial scales)	2 - 15	--	> 2	a. >20 meters from trees. b. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. c. Unrestricted airflow in 3 of 4 cardinal wind directions. d. No furnace or incineration flues should be nearby. e. Spacing from roads varies with height of monitor.
SO ₂ (All spatial scales)	3 - 15	> 1	> 1	a. Probe on roof or intermediate height on a building must be <0.8 of the mean height of the buildings in the neighborhood. b. >20 meters from trees. c. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. d. Unrestricted airflow in 3 of 4 cardinal wind directions. e. No furnace or incineration flues should be nearby.
CO (Middle scale)	3 ± 1/2	> 1	> 1	a. >10 meters from intersection and at midblock location. b. 2-10 meters from roadway.
CO (Neighborhood scale)	3 ± 1/2	> 1	> 1	a. >35 meters from roadway. b. Unrestricted air flow in 3 of 4 cardinal wind directions.
O ₃ (All spatial scales)	3 - 15	> 1	> 1	a. >20 meters from trees. b. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. c. Unrestricted airflow in 3 of 4 cardinal wind directions. d. Spacing from roads varies with roadway traffic (see text).
NO ₂ (All spatial scales)	3 - 15	> 1	> 1	a. >20 meters from trees. b. Distance from sampler to obstacle, such as buildings, must be at least twice the height the obstacle protrudes above the sampler. c. Unrestricted airflow in 3 of 4 cardinal wind directions. d. Spacing from roads varies with roadway traffic (see text).

^a When probe is located on rooftop, this separation distance is in reference to walls, parapets, or penthouses located on the roof.

^b Distance is dependent on height of furnace or incineration flue, type of waste or fuel burned, and quality of fuel (sulfur and ash content). This is to avoid undue influences from minor pollutant sources.

Source: Proposed regulation on air monitoring prepared by EPA that appeared in the August 7, 1978, Federal Register

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